

base stations 70. As the speed of travel of the mobile unit 20 increases, a handoff will occur between the fixed base station and a moving base station. The procedures for determining whether a mobile unit is to be served by a fixed base station or a moving base station are the same procedures as described earlier herein in determining which moving base station is selected to serve a mobile unit, i.e., based on signal strength and error rate. Thus, when a call involving a mobile unit is initiated or when it is determined that a handoff should occur, the mobile unit may be handed from a moving station to a fixed station, or vice versa. Each mobile unit monitors pilot signals from fixed and moving base stations and synchronizes to the base station providing the best signal. The mobile unit may "connect" with three fixed or moving base stations while searching for a fourth in what is known as the "soft" hand-off mode. As the speed of the vehicle increases, fixed or slow moving base stations will be dropped. In more congested areas where traffic speed will vary between 0 and 60 miles per hour, base stations speed may, for example, be set to move at 30 mph. The moving base station should then be able to accommodate all traffic in the 0-60 mph range.

It will be understood that the above-described arrangement is merely illustrative of the application of the principles of the invention and that other arrangements may be devised by those skilled in the art without departing from the scope of the invention as defined by the appended claims.

CLAIMS

WHAT WE CLAIM IS:

1. ~~Interface apparatus for establishing signal connections between a telephone office connected to a telephone network and mobile telephone units transmitting radio signals and moving in a specified direction, the interface apparatus comprising:
 - a stationary interface unit connected to the telephone office via a signal transmission connection;
 - a plurality of spaced apart movable base stations, each of the base stations uniquely associated with the telephone office and supported on a conveying device for limited~~

movement in the specified direction within an area defined relative to the stationary interface, the movable base stations each responsive to radio signals transmitted by the mobile telephone units to transmit corresponding radio signals to the stationary interface unit and the stationary interface unit responsive to the radio signals transmitted from the movable units to transmit signals corresponding to the signals transmitted from the movable units to the telephone office via the signal transmission connection.

2. The interface apparatus in accordance with claim 1 wherein the mobile telephone unit moves along a roadbed and the movable interface unit is movably supported on conveying apparatus disposed along path extending parallel to the roadbed.

3. The interface apparatus in accordance with claim 2 wherein the conveying apparatus comprises a rail movably supporting the movable interface unit.

4. The interface apparatus in accordance with claim 2 wherein the stationary interface unit is disposed on one side of the conveying apparatus opposite the roadbed.

5. The interface apparatus in accordance with claim 1 wherein the movable interface unit comprises signal processing circuitry and a first radio antenna directed toward the mobile telephone unit and a second radio antenna directed toward the stationary interface unit and wherein the stationary interface unit comprises signal processing circuitry and a radio antenna directed toward the movable interface unit, the movable interface unit responsive to radio signals received at the first antenna to transmit corresponding radio signals via the second antenna to the stationary interface unit and the stationary interface unit responsive to radio signals received via the radio antenna of the stationary interface unit to transmit corresponding signals to the telephone office via the signal transmission connection.

6. The interface apparatus in accordance with claim 1 wherein each of the movable base stations has an associated service area and each of the movable base stations is operative to hand-off and receive existing calls to mobile units in an associated service area.

7. The interface apparatus in accordance with claim 1 wherein each of the movable base stations has an associated service area and each of the movable base stations is operative to perform a plurality of functions including locating an identified mobile unit in an associated service area.

8. The interface apparatus in accordance with claim 1 wherein the radio signals transmitted between the movable interface unit and the stationary interface unit are transmitted in accordance with a code division multiple access, direct sequence, spread spectrum transmission signalling protocol.

9. The interface apparatus in accordance with claim 8 wherein signals transmitted from the mobile telephone unit to the movable interface unit are transmitted at a first power level and signals transmitted from the movable interface unit to the stationary interface unit are transmitted at a second power level higher than the first power level.

10. The interface apparatus in accordance with claim 8 wherein data transmitted between the stationary interface unit and the movable interface unit is transmitted in a time division duplex manner.

11. The interface apparatus in accordance with claim 8 wherein data transmitted between the stationary interface unit and the movable interface unit is transmitted in a frequency division duplex manner.

12. The interface apparatus in accordance with claim 8 wherein each movable interface unit is synchronized to a selected stationary unit by transmission of pilot signals to the selected unit.

13. The interface apparatus in accordance with claim 1 wherein the movable interface unit is responsive to radio signals received from the stationary interface unit to transmit corresponding radio signals to the mobile telephone unit and wherein signals transmitted from the stationary interface unit to the movable interface unit are transmitted at a first power level and signals transmitted from the movable interface unit to the mobile telephone unit are transmitted at a second power level higher than the first power level.

14. Interface apparatus for establishing signal connections between a telephone office and a plurality of mobile telephone units transmitting radio signals, certain of the mobile telephone units moving in a specified direction, the interface apparatus comprising:

a plurality of movable interface units uniquely associated with the telephone office; and

a plurality of stationary interface units connected to the telephone office via a signal transmission connection;

each of the movable interface units movable in the specified direction and within a limited area defined relative to the stationary interface units and responsive to radio signals transmitted by a mobile telephone unit to transmit corresponding radio signals in the direction of the stationary interface units, each of the stationary interface units responsive to radio signals transmitted from an adjacent movable unit to transmit signals corresponding to the signals transmitted from the adjacent movable unit to the telephone office via the signal transmission connection.

15. The interface apparatus in accordance with claim 14 wherein:

the movable interface units are movable along an interface unit path extending in a direction parallel to the predefined path and having a first side adjacent the predefined path;

the stationary interface units are spaced apart and disposed on a second side of the interface unit path opposite the first side of the interface unit path;

each of the movable interface units comprises signal processing circuitry and an associated first radio antenna directed toward the first side and an associated second radio antenna directed toward the second side;

each of the stationary interface units comprises signal processing circuitry and an associated radio antenna directed toward the interface unit path;

each of the movable interface units is responsive to radio signals received at the associated first antenna to transmit radio signals via the associated second antenna to the stationary interface unit; and

each of the stationary interface units is responsive to radio signals received via the associated radio antenna to transmit corresponding signals to the telephone office via the signal transmission connection.

16. The interface apparatus in accordance with claim 14 wherein the movable units move along the interface unit path at a predefined speed.

17. The interface apparatus in accordance with claim 16 wherein the predefined speed is a function of an average speed of the plurality of mobile telephone units.

18. The interface apparatus in accordance with claim 14 and further comprising a plurality of mobile telephone units moving along another path in an opposite direction opposite the specified direction and a plurality of movable interface units movable in the opposite direction and wherein:

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the plurality of mobile telephone units moving in the specified direction move along a first roadbed and the plurality of mobile telephone units moving in the opposite direction move along a second roadbed spaced apart from the first roadbed;

the plurality of movable interface units movable in the specified direction are disposed along one side of the first roadbed adjacent the second roadbed;

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the plurality of movable interface units movable in the opposite direction are disposed along one side of the second roadbed adjacent the first roadbed; and

the plurality of stationary interface units are disposed between the plurality of movable interface units movable in the specified direction and the plurality of movable interface units movable in the opposite direction.

19. The interface apparatus in accordance with claim 14 and further comprising a plurality of stationary interface units connected to the telephone office via a signal transmission connection and responsive to radio signals transmitted by a mobile telephone unit to transmit corresponding signals to the telephone office.

20. The interface apparatus in accordance with claim 14 wherein each of the movable base stations has an associated service area and each of the movable base stations is operative to perform hand-off and receiving functions relative to existing calls for mobile units within an associated service area.

21. The interface apparatus in accordance with claim 14 wherein each of the movable base stations has an associated service area and is operative to perform a plurality of functions, including locating an identified mobile unit in an associated service area.

22. The interface apparatus in accordance with claim 14 wherein the telephone office is connected to a telephone network and wherein a plurality of stationary interface units are responsive to radio signals transmitted by an identified one of the movable interface units and

each stationary interface unit responsive to radio signals from the identified movable interface unit is operative to compute a signal quality indication for data represented by the transmitted radio signals and to transmit to the telephone office data signals corresponding to the transmitted radio signals together with a corresponding signal quality indication, the telephone office responsive to the receipt of the data signals and signal quality indication to transmit to the telephone network data received from a selected one of the stationary interface units having a preferred signal quality indication.

23. The interface apparatus in accordance with claim 14 wherein each of the stationary units is responsive to a data message received from the telephone office to transmit a corresponding radio message to selected ones of the movable interface units and wherein the telephone office is operative to transmit a predetermined data message intended for a selected one of the movable interface units to selected ones of the stationary interface units and each of the selected ones of the stationary interface units is responsive to receipt of the predetermined data message to transmit corresponding radio signals to the selected one of the movable interface units.

24. The interface apparatus in accordance with claim 23 wherein the predetermined data message is transmitted to each of the selected ones of the stationary interface units in a timed sequence and the selected ones of the stationary interface units transmits the corresponding radio signals in a corresponding timed sequence.

25. A mobile telephone system comprising:
a telephone office connected to a telephone network;
a stationary interface unit connected via a signal transmission connection to the telephone office;
a movable interface unit uniquely associated with the telephone office and movable at a predetermined speed along a first predefined path of travel and in a direction

defined by a direction of travel of a mobile telecommunication unit traveling along a second predetermined path defined within a limited area defined relative to the stationary interface;

the stationary interface unit comprising signal processing circuitry and a stationary interface radio antenna directed toward the first predefined path of travel;

the moving interface unit comprising signal processing circuitry and a first radio antenna directed toward the second predefined path of travel and a second radio antenna directed toward the stationary interface unit;

the moving interface unit responsive to radio signals received at the first radio antenna to transmit corresponding radio signals via the second radio antenna to the stationary interface and the stationary interface responsive to radio signals received at the stationary interface radio antenna to transmit corresponding signals to the telephone office via the signal transmission connection.

26. A mobile telephone system arranged for communication with mobile telephone units and comprising:

first and second telephone offices connected to a telephone network;

a first closed loop having opposite ends and a second closed loop having opposite ends, one of the opposite ends of the first loop disposed adjacent one of the opposite ends of the second loop, each of the loops movably supporting a plurality of movable base stations;

a plurality of stationary interface units disposed adjacent each of the loops, each connected to one of the telephone offices;

each movable base station communicating with a stationary interface unit and responsive to radio telephone signals transmitted by a mobile telephone unit to establish a telephone communication connection with one of the telephone offices via one of the stationary interface units;

the telephone offices operative to record position of each of the movable base stations on each loop and to transmit an alert signal via one of the stationary interface units to an identified movable base station approaching one of the opposite ends of one of the loops;

the identified movable base station responsive to the alert signal to indicate to mobile units communicating with the identified movable base station to establish a telephone communication connection to another base station.

27. The system in accordance with claim 26 wherein one of the opposite ends of one of the loops overlaps one of the opposite ends of another of the loops.

28. The apparatus in accordance with claim 1 wherein the movable interface unit is further responsive to radio signals received from the telephone office via the stationary interface unit to locate an identified mobile unit and to transmit to the identified mobile unit signals corresponding to radio signals received from the telephone office.

29. The apparatus in accordance with claim 1 and comprising a plurality of stationary interface units and wherein the area is defined relative to the plurality of interface units.

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